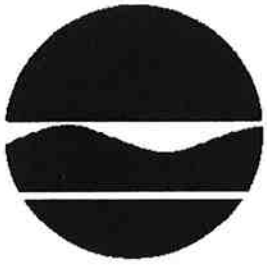
SUPERFUND STANDBY PROGRAM
New York State
Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-7010

NIAGARA MOHAWK POWER CORPORATION
HIAWATHA BLVD. (SITE ID 227), ERIE BLVD. (SITE ID 228) & WALLACE STREET GARAGE (SITE ID 232)

SITE SUMMARY REPORT
REVISION 1



Onondaga Lake Project
Task 5: 104(e) Review

Site No. 734030-002
Work Assignment Number D003060-9

Prepared by

TAMS CONSULTANTS, Inc.
300 Broadacres Drive
Bloomfield, New Jersey 07003

June 1998

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1.0 SITE DESCRIPTION

In general, the information referenced in this report was obtained from the 104(e) responses of the Niagara Mohawk Power Corporation (NMPC, Company ID 2012). NMPC's initial response to the joint request for information was submitted on April 4, 1995. In this correspondence, NMPC stated that additional time was needed to complete their response to the joint request for information because of the large number of potential historic and current sites owned by NMPC in the Onondaga Lake area. NMPC provided a more complete response to the joint request for information on April 28, 1995 (see TAMS' Completeness Review A dated July 31, 1995). NYSDEC and USEPA submitted a request for additional information to NMPC on January 4, 1996. NMPC provided a supplemental response dated February 9, 1996. A Completeness Review B was prepared by TAMS dated August 29, 1996. Additional material was provided by NYSDEC on several occasions throughout the review period.

1.1 Location

NMPC has hundreds of "facilities" throughout its system. NMPC and its predecessors have a history of operation that dates back to the 1840s. NMPC provided a list of all facilities within a 50-mile radius of Onondaga Lake (Mailing No. 2, pp. 000031 - 000036) that may have generated, handled, transported, treated, stored or disposed of hazardous substances or wastes. Of these, NMPC identified six sites within the Onondaga Lake watershed that it believes fall within the request for information. Three of these sites associated with historic manufactured gas plant (MGP) operations, the former Hiawatha Boulevard site (Site ID 227), the Erie Boulevard site (Site ID 228) and the former Wallace Street Garage (Site ID 232), are discussed in this Site Summary Report. These three sites, in relation to Onondaga Lake, are shown in Figure 1. A separate Site Summary Report

for the NMPC Seventh North Street facility (Site ID 231) was submitted to NYSDEC (TAMS, February 25, 1998). A Site Summary Report for the former Solvay Bridge Street facility (Site ID 229) and the Syracuse Fire Training Center (Site ID 230) was also submitted to NYSDEC (TAMS, April 20, 1998).

The Hiawatha Boulevard site is located on West Hiawatha Boulevard south of the Barge Canal (Onondaga Creek) in the City of Syracuse, New York. This site was originally a manufactured gas plant operated by NMPC and its predecessors. The original site occupied 20 acres and was in operation from approximately 1925 to 1958. In the mid-1970s, a 16-acre parcel of the site was used in the expansion of the Onondaga County Metropolitan (METRO) Sewage Treatment Plant (STP). NMPC currently maintains a service center on the remaining 4-acre parcel consisting of a garage, offices and a meter house (p. 000012). A map of the Hiawatha site is provided as Figure 2. This map is relatively recent and shows the METRO facility expansion onto property formerly occupied by the MGP operation. The MGP facility, which no longer exists, is not shown on the map.

The Erie Boulevard site is located at 300 Erie Boulevard West in the City of Syracuse, New York (see Figure 3). The site is currently the location for NMPC's Corporate Headquarters and Central Office Complex. Previously, this site was also occupied by a NMPC manufactured gas plant which operated from approximately 1849 to 1933. The main office building was constructed in 1931 (p. 000021).

The Wallace Street Garage site was located on Wallace Street in the City of Syracuse, New York (see Figure 3). Originally, the property occupied by the garage facility was part of the Erie Boulevard MGP operation (Site ID 228). The garage facility was in full operation from the 1950s until 1966 when its function as a general service center was

moved to the NMPC Seventh North Street site on Henry Clay Boulevard in the Town of Clay (Site ID 231). From 1966 to 1979 limited automotive services were performed at the Wallace Street Garage only on vehicles operating out of the Erie Boulevard Central Office Complex. This garage was closed in 1979 and the remaining operations were transferred to a new garage located on Towpath Road in the Town of DeWitt. The garage property is now part of the Corporate Headquarters and Central Office Complex at 300 Erie Boulevard West (Site ID 228).

1.2 Geology

The surficial geology of the Syracuse area was strongly influenced by the most recent glacial advance (Wisconsin age, 12,000 to 14,500 years ago). Syracuse occupies a region that was covered by Lake Iroquois, a large glacial lake situated in front of the ice margin. The broad flat-lying plains situated from Syracuse north to Lake Ontario were formed beneath Lake Iroquois and are characterized by lacustrine fine sand and silt deposits. Additional glacial features which are common to the region are moraines, drumlins, U-shaped valleys and meltwater channels. The last of these features is important in understanding the geology at the NMPC sites. Onondaga Lake and all its major tributaries lie within glacial meltwater channels. These features originally formed as a conduit to carry meltwater away from the glacier. They typically transmitted large volumes of water at high velocities. Sediment types characteristically found in meltwater channels are sands and gravels. In the Syracuse region, these relict features form important water bearing and transmitting units which lie in an irregularly branching, net-like pattern throughout the area.

The bedrock geology of the greater Syracuse area includes Lower to Middle Paleozoic age sedimentary rocks predominated by carbonate (dolostone and limestone) and shale and

containing some sandstone, siltstone and evaporites. Bedrock directly beneath the NMPC sites in Syracuse (as well as underneath Onondaga Lake) is the Silurian Vernon Shale (Rickard and Fischer, 1970) which has low permeability, but does possess secondary porosity due to fractures.

1.3 Hydrogeology

According to the USGS Syracuse West, NY Quadrangle map, ground surface elevations at the three sites range from approximately 370 ft to 400 ft NGVD. The Hiawatha Boulevard site is on the shore of Onondaga Lake. Ground surface elevations at the site are approximately 7 ft above the level of the lake or 370 ft. Attachment B to NMPC's initial submittal indicates that the site topography has undergone significant changes throughout its history. The land currently occupied by the Hiawatha Boulevard site is reclaimed land. In the early 1800s, the level of Onondaga Lake was lowered approximately 10 ft in elevation as a result of the construction of the Erie Canal. In about 1850, the level of the lake was raised about six ft to its present elevation. The exposed land area along the southern shoreline was marshy and not suitable for development. The natural course of Onondaga Creek meandered through this area. In the late 1800s the area was leased by Allied Chemical & Dye Corporation, Solvay Process Division for use as a fill area (Waste Bed G). According to Effler (1996), the hydraulic conductivity of the waste beds is relatively low (average of 4×10^{-5} cm/sec). By the late 1920s, the creek had been permanently rerouted northeast of the site connecting with the Barge Canal (pp. 000040 - 000041). Groundwater elevations in this area are approximately 365 ft to 370 ft NGVD (Effler, 1996) with a flow direction towards Onondaga Lake and Onondaga Creek.

The Erie Boulevard site and Wallace Street Garage are located on the eastern (right) bank of Onondaga Creek in downtown Syracuse. Ground surface elevations range from 387 ft to 400 ft NVGD across the site and are approximately 388 ft to 391 ft adjacent to Onondaga Creek (p. 000560). Depth to groundwater ranges from 19 ft to 32 ft below ground surface (bgs). The elevation of the groundwater table is 368 ft to 369 ft. The general direction of groundwater flow is to the north (p. 000195). The present water level in Onondaga Creek is approximately 22 feet below the grade of the parking area (p. 000114). The surface water elevation of the creek is approximately 367 ft to 368 ft, which indicates that groundwater elevations in the area are slightly higher than the water level in the creek. Historic information for the area indicates that a dam was constructed in 1805 at Genesee Street which is the northern property boundary of the site. This dam was washed out in 1807 and was rebuilt at Water Street, which is one block south of the present location of Erie Boulevard. A mill race was constructed east of, and parallel to, Onondaga Creek on the site in the 1820s. In 1824, the Erie Canal was constructed along what is presently Erie Boulevard. The mill race was filled in the late 1840s and the Erie Canal was filled in 1924 (pp. 000114 - 000115). Both of these features could affect groundwater flow and contaminant movement at the site, providing preferential pathways for fluid movement due to differences in the characteristics of the fill material compared to the native soils.

1.4 Surface Water Hydrology

The Hiawatha Boulevard site is bounded by the Barge Canal to the northeast and Onondaga Lake to the northwest. According to the USGS Syracuse West Quadrangle, the elevation of Onondaga Lake and the Barge Canal is 363 ft NVGD. Surface elevations at the site are approximately 7 ft to 10 ft above the level of the lake. As shown on Figure 2, the limits of the former MGP site are approximately 80 ft from Onondaga Lake and

approximately 30 ft to 50 ft from the Barge Canal. Given that the site was approximately 20 acres, prior to the expansion of the METRO STP, stormwater at the Hiawatha Boulevard site most likely flowed to both the Barge Canal and Onondaga Lake.

NMPC currently discharges non-contact cooling water and stormwater from their Corporate Headquarters (formerly the Erie Boulevard and Wallace Street Garage sites) into Onondaga Creek under a New York State Pollution Discharge Elimination System (SPDES) permit. Onondaga Creek flows along the western property boundary of the Erie Boulevard site. The elevation of the creek is approximately 22 ft below the level of the parking lot at the site. Onondaga Creek near the site is approximately 4,000 ft upstream of the Barge Canal Terminal and approximately 8,500 ft upstream of Onondaga Lake.

2.0 SITE HISTORY

2.1 Owners/Operators

NMPC owns and operates hundreds of sites in the Onondaga Lake drainage basin. Many of these sites are small electric substations and natural gas regulating stations. NMPC identified six sites that it believes fall within the requirements of the 104(e) request for information. Three of these sites associated with the former MGP operations are discussed in this Site Summary Report. NMPC did not include a detailed history of the predecessor companies that were merged to form the present day corporation.

The Hiawatha Boulevard site is situated along the southeastern shore of Onondaga Lake. This area was a primary location for salt production from the late 1770s until the late 1880s. In the early 1800s, the level of Onondaga Lake was lowered approximately 10 ft as a result of the construction of the Erie Canal. In the 1850s, the level of the lake was raised by about 6 ft and the shoreline was advanced to its present day level. However, the land exposed along the southern shore was marshy and unsuitable for development. NMPC reported that a map from the 1892 Atlas of the City of Syracuse indicated that the natural course of Onondaga Creek flowed south to north, meandering through the marshy area to the east of the site. By the late 1920s, Onondaga Creek had been permanently rerouted northeast of the site, flowing into the Barge Canal. NMPC reported that records from the late 1800s indicate the site was leased to the Allied Chemical & Dye Corporation, Solvay Process Division from an unnamed owner for use as a fill area for Solvay process waste. A 1910 Sanborn Map indicates that the Syracuse Reduction and Manufacturing Company (a fertilizer manufacturer) was located adjacent to Hiawatha Boulevard along the west bank of Onondaga Creek, the approximate location of the NMPC site. The Syracuse Lighting Company began construction of the MGP facility in 1922. The facility went on

line in 1925 producing coal gas. In 1937, the Syracuse Lighting Company was consolidated into Niagara Hudson Public Service Corporation which was renamed the Central New York Power Corporation. A carbureted water gas plant began operation in 1941. By 1947, this facility ceased coal gas production as natural gas replaced manufactured gas. The carbureted water gas plant was left to produce gas on a standby basis. NMPC acquired the plant in 1950. In 1958, the carbureted water gas plant was dismantled. During the mid-1970s, construction began on the expansion of the Onondaga County Metropolitan Sewage Treatment Plant. Approximately 16 acres of the original 20-acre site were used for the expansion. NMPC maintains an operational service center on the remaining 4-acre parcel which consists of a garage, offices, and a meter house (pp. 000040 - 000042, and 000045).

The history of the Erie Boulevard and Wallace Street Garage sites will be discussed together since they are located on adjoining lots. Onondaga Creek was dammed at Genesee Street in 1805 with two mills operating along the east bank of the creek. In 1807, the dam washed out and was rebuilt upstream at West Water Street. In 1824, a mill race was constructed east of, and parallel to, Onondaga Creek. The mill race traversed the site. Also in 1824, the Erie Canal was constructed in an aqueduct that crossed over both the mill race and Onondaga Creek. Tax maps from 1845 indicate that three mills and a tannery were located between the mill race and Onondaga Creek. A saw mill and linseed oil mill were located near Genesee Street. The first gas plant was constructed in 1849 by the Gas Light Company of Syracuse. Several holders were added over the years. The original plant used coal to manufacture gas. In 1896, the facility was sold to the Syracuse Gas Company, who operated the plant until 1902 when operations were sold to the Syracuse Lighting Company. Also in 1896, the Erie Boulevard plant began to manufacture gas using the carbureted water gas process. In 1924, the Erie Canal was filled in (presently Erie Boulevard). The coal gas plant was dismantled in the early 1930s

and office and service buildings were constructed. Mechanic and Wallace Streets were incorporated into the NMPC office complex. In 1937, this facility was merged into the Central New York Power Corporation. In 1938, the water gas plant was dismantled. NMPC acquired the facility in 1950. All gas holders were removed by the 1960s (pp. 000114 - 000115).

The Wallace Street Garage was in full operation from the 1950s until 1966 when its function as a general service center was moved to the Henry Clay Boulevard facility (Site ID 231). From 1966 to 1979, only limited automotive services were performed at the Wallace Street Garage on vehicles operating out of the Central Office Complex. This garage was closed in 1979 and the remaining operations were transferred to a new garage located on Towpath Road in the Town of DeWitt.

2.2 Site Operations

At the Hiawatha Boulevard site, NMPC and its predecessors manufactured gas using coal from 1924 to 1947. Gas was also manufactured using the carbureted water gas process from 1941 to 1947. Production continued on a standby basis until 1958. The coal gas process used coal as the feed stock. Coal was heated to drive off the gases which were collected, purified and stored in holders for distribution. By-products from coal gas include clinker and ash, coal tar, oil sludge, ammonia liquor, gas condensates (aromatic-rich oils), tar decanter sludges, ammonia, cyanide and sulfur salts. Carbureted water gas production is an enrichment process that increased the BTU value of the gas. Hot coal gas was enriched in a carburetor with a petroleum distillate (e.g., Bunker C oil) then passed through a superheater to crack the distillate (pp. 000076-000077). By-products from water gas are similar to coal gas and include tar, tar sludges, ash, clinker and coke breeze, and

emulsions and liquors (p. 000043). A portion of the site is presently used as a service center consisting of a garage, an office and a meter house.

At the Erie Boulevard MGP facility, NMPC and its predecessors produced coal gas from 1849 to the 1930s. Carbureted water gas was produced from 1896 to 1938. By-products are similar to those discussed for the Hiawatha Boulevard site. During World War I (1917 to 1918), the plant produced toluol (syn. toluene) used for the manufacturing of TNT.

The former Wallace Street Garage was constructed over former gas holders at the Erie Boulevard MGP site (p. 000115). A review of maps provided by NMPC indicate that the garage was constructed over Relief And Storage Holder No. 8 and Storage Holder No. 4 (pp. 000129 - 000131). The Wallace Street Garage was in full operation from the 1950s until 1966 when its function as a general service location for Syracuse area vehicles was transferred to the Seventh North Street Service Center (NMPC Site ID 231). From 1966 to 1979, only limited automotive services were performed at this location on vehicles operating out of the Erie Boulevard Corporate Headquarters. In 1979, these remaining operations were transferred to a new garage located on Towpath Road in DeWitt (p. 000020). Waste oils generated at the Wallace Street Garage consisted of automotive oils removed from cars and small trucks. Larger trucks could not be serviced at this facility due to low overhead clearance on the ramp leading to the garage.

2.3 Generation and Disposal of Wastes

NMPC stated that it was not in possession of information concerning by-product quantities or final disposition of wastes from the former Hiawatha Boulevard MGP facility (p. 000044). However, a general list of the types of by-products typically associated with

manufactured gas operations was included. The following is a list of associated by-products:

- Clinker and ash from the burning of coal. Trace metals typically associated with gas manufacturing include antimony, boron, cadmium, chromium, cobalt, copper, lead, manganese, and nickel;
- Coal tar from carbureted water gas production which contains polycyclic aromatic hydrocarbons (PAHs) and volatile organics such as benzene, toluene, ethylbenzene and xylenes (BTEX). True "coal tars" produced from the carbonization of coal also commonly contained phenols;
- Oil sludge, ammonia liquor and gas condensates from the cooling of the gas. These condensates consist mostly of aromatic-rich oils; and,
- Purifier waste from the utilization of lime or in later times, wood chips impregnated with iron filings. This waste often contained cyanides.

The by-products generated at the Erie Boulevard site are similar to those generated at the Hiawatha Boulevard site. This site is currently used for the Corporate Headquarters. Records of the quantities of MGP by-products produced at the Hiawatha and Erie Boulevard MGP sites are incomplete and records of the quantity and location of by-products disposal do not exist (p. 000117).

The former Wallace Street Garage operated from the early 1950s until 1979 when all operations were moved to other facilities. NMPC stated that the only waste generated at this facility consisted of waste engine oil removed from company vehicles. Used oil was stored in a steel tank located in the cellar of the garage. When the level in the tank was noted to be approaching capacity, a waste oil contractor was called to empty the tank. NMPC believes that the contractor used for this site was Sietz Oil. Records concerning

the quantity of waste oil generated at the garage could not be located by NMPC. NMPC does not possess information concerning the subsequent disposition of oil by Sietz Oil.

3.0 POTENTIAL PATHWAYS FOR RELEASE OF HAZARDOUS SUBSTANCES TO THE LAKE SYSTEM

3.1 Soil

A Preliminary Site Assessment (PSA) is currently being implemented at the Hiawatha Boulevard site. The soil sampling component of the PSA has not yet been conducted. The potential for soil contamination at the site is high due to the size of this former MGP operation and the number of underground transmission lines typical of these facilities. Surface discharges of oil drips and other tarry by-products are potential mechanisms for contaminants to reach the soils at the site. A large coal supply was also maintained at the site. Leaching from this coal pile could introduce contaminants to the soils. The site is located on the shore of Onondaga Lake and the Barge Canal.

NYSDEC forwarded preliminary/draft analytical data for the Erie Boulevard site which included surface and subsurface soil data from test pits and soil borings. A total of 45 subsurface soil samples from 16 soil borings were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), TCL pesticides/PCBs, and Target Analyte List (TAL) metals. Nine subsurface soil samples were analyzed for Toxicity Characteristic Leachate Procedure (TCLP) parameters. These data indicate that both surface and subsurface soils at the site have been impacted from the former MGP operations (see Section 5.3). Contaminant concentrations are particularly high in the western portion of the site and extend to depths of over 80 ft bgs. The western property boundary of this site is Onondaga Creek.

The former Wallace Street Garage has not been directly investigated. Soil sampling performed on the garage property was directed at investigating former Erie Boulevard

MGP operations. The potential contribution to soil contamination by former garage activities is difficult to assess. Although NMPC made no mention of floor drains at the former garage, there is the possibility that when the garage was built in the early 1950s, that floor drains in the garage were connected to drywells. If drywells were present, this would provide a direct pathway for used automotive fluids to reach the soils beneath the building.

3.2 Surface Water

The Hiawatha Boulevard site is bounded to the north by the Barge Canal and to the west by Onondaga Lake. Although no specific information was provided concerning stormwater management at the site, it is assumed that stormwater was directed to both of these waterbodies. The only analytical data available for review for this site is Onondaga Lake sediment data collected adjacent to the site in the summer of 1995 (see Section 5.3). The results of this sampling indicate that former site operations have impacted the sediments of Onondaga Lake. There was no soil or groundwater data available to further assess the potential impacts from this site on the Barge Canal and Onondaga Lake. The historic potential for surface water runoff to have transported surficial soil contamination to the lake is high given the short distances involved. Currently, the potential for surface water runoff as a transport mechanism is low as most of the site is occupied by the METRO Plant and is paved. The remaining portion of the property on which NMPC operates a service center is either paved or has grass rooted in imported topsoil.

Of greater concern at the present is the potential for non-aqueous phase liquids (NAPLs) to migrate off-site and reach the lake. NAPL forms when the solubility of an organic compound is exceeded in groundwater. Below the solubility limit, an organic liquid will dissolve in groundwater. Once the solubility limit is exceeded, the organic liquid will

form a free-phase liquid separate from groundwater, although a portion of the liquid will continue to be present as a dissolved phase in groundwater. LNAPLs are light non-aqueous phase liquids, such as benzene, ethylbenzene, toluene, xylenes and naphthalene (Montgomery, 1990). These types of compounds will pool or "float" on top of the groundwater interface. Migration of LNAPLs is governed by the direction of groundwater flow. DNAPLs are dense non-aqueous phase liquids such as most PAHs (naphthalene is an exception). Like LNAPLs, these compounds will dissolve in groundwater if the concentrations are less than their respective solubility limit. Once the solubility limit is exceeded, these compounds will form a free-phase liquid. Since the density is greater than water, these compounds will "sink" through the groundwater column with gravity as the primary driving force. DNAPLs will continue to sink until an aquitard such as silt or clay is encountered. In some instances, fine-grained sand units can also impede DNAPLs if gravity is insufficient to overcome the capillary pressures exerted on the liquids.

In the specific case of coal tars, the actual behavior of the NAPL is governed by the mixture of chemicals rather than individual components. As none of the individual compounds were present as pure products during the production of the manufactured gas, the behavior of the coal tar will be dependent on the specific gravity of the mixture rather than the specific gravity of individual components. For instance, coal tars manufactured in the U.S. have specific gravities of about 1.18, i.e., heavier than water (Standen, 1969). Consequently, a DNAPL mixture composed primarily of PAHs may also contain lesser amounts of benzene, toluene, ethylbenzene, xylenes and naphthalene, each of which have specific gravities less than water. However, these LNAPL components will remain suspended in the coal tar mixture and migrate with the DNAPL rather than acting as individual compounds.

Of particular interest for the Hiawatha Boulevard site is the presence of the Solvay waste beds at shallow depths beneath the site. The waste beds have been shown to have relatively low hydraulic conductivities (NYSDEC, April 1997) which would limit the downward migration of DNAPLs, possibly creating a surface on which these liquids would pool. Migration of DNAPLs would then be governed by the topography of the waste beds, and not necessarily move in the same direction as groundwater. If present, LNAPLs would migrate off-site with groundwater as it feeds into Onondaga Lake and the Barge Canal.

Although the presence of NAPLs at the Hiawatha Boulevard site has not been documented, the potential for these compounds to be present is very high given the nature of the former MGP operations. The extensive NAPL contamination documented at the NMPC Erie Boulevard site, where similar MGP operations occurred, suggests that the Hiawatha Boulevard site could also be contaminated with NAPLs. A PSA is currently being conducted at the Hiawatha Boulevard Site.

The Erie Boulevard site is bounded to the west by Onondaga Creek, approximately 1.6 miles from Onondaga Lake. Surface water samples were not collected during the Erie Boulevard PSA. Sediment samples collected in Onondaga Creek adjacent to the site indicate that former MGP operations have impacted the creek (see Section 5.3). The historic potential for surface water runoff to have transported contaminants to Onondaga Creek is high given the proximity of the site to the creek. Currently, the potential for surface water runoff as a transport mechanism is low as most of the contaminated soil at the site is covered by pavement. According to the NYSDEC Project Manager for the site, a NAPL discharge to Onondaga Creek was observed in the summer of 1996 (NYSDEC, April 1997). In late 1996, NMPC installed a sheet-pile cutoff wall in Onondaga Creek to

prevent further discharges. The effectiveness of this cutoff wall in reducing or eliminating the NAPL discharges to the Creek was not stated.

The former Wallace Street Garage occupied the eastern portion of the former Erie Boulevard MGP site. There is no site-specific analytical data to assess the potential contribution of the Wallace Street Garage operations on the impacts attributed to the former MGP which occupied the site prior to the garage operations.

3.3 Groundwater

Figure 2 shows the proposed locations of monitoring wells to be installed as part of the PSA at the Hiawatha Boulevard site. However, the monitoring wells have not yet been installed due to property access issues and groundwater data are not available for review (NYSDEC, December 1997). It is possible that potential soil contamination could have impacted groundwater. Given the size of former MGP operations at the site, the potential presence of both LNAPLs and DNAPLs at the site is also a concern. LNAPLs would tend to accumulate at the soil-water interface and migrate with the groundwater towards Onondaga Lake and the Barge Canal. DNAPLs would tend to pool on top of the Solvay waste beds and flow off-site following the general topography of the waste beds. Given the shallow depth to the top of the waste beds and the close proximity of the site to the lake, the potential for NAPL contamination to have reached the lake is also very high.

Groundwater data from seven shallow and three deep monitoring wells were obtained by NYSDEC from the ongoing PSA at the Erie Boulevard site. Analytical data indicate that groundwater at the site has been impacted by former site operations (see Section 5.3). According to the NYSDEC Project Manager for the site, NAPLs have been reported in the subsurface and were observed discharging into Onondaga Creek adjacent to the site in

1996 (NYSDEC, April 1997). Concentrations of BTEX in the shallow aquifer were several thousand times higher than the Class GA groundwater standards. Monitoring wells in the deeper portion of the aquifer also reported concentrations of benzene, ethylbenzene and xylenes significantly above groundwater standards. Several SVOCs, mostly PAHs, were reported at concentrations several thousand times greater than the Class GA groundwater standards in shallow monitoring wells including acenaphthene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, naphthalene, 2-methylnaphthalene and phenol. Monitoring wells in the deeper portion of the aquifer reported concentrations of acenaphthene, naphthalene, benzo(a)pyrene and chrysene above their respective groundwater standards. Sheens were also noted on split spoon soil samples from deep soil borings.

3.4 Air

Both the former Hiawatha Boulevard and Erie Boulevard MGP facilities used coal to produce gas and to fire the boilers. The amount of coal used at these sites was not documented but NMPC did state that the Hiawatha Boulevard site maintained a 48,000-ton coal stockpile to insure an adequate supply during coal strikes (p. 000041). Burning coal can release many organic compounds, including PAHs and metals, into the atmosphere with the potential that these compounds will be washed out of the air during precipitation events (wet deposition) and be deposited on the ground within the Onondaga Lake watershed. Dry deposition of particle-bound contaminants can also transport pollutants from the air to the land or water. Once on the ground, surface water runoff could transport these compounds to the lake system.

Operations at the former Wallace Street Garage service center and the current service center at the Hiawatha Boulevard site have included automobile and truck repair. The

servicing and operation of these vehicles would produce engine exhaust and hence, air pollution. Another potential source of air pollution would be parts washing during engine repair. However, the overall contribution of the NMPC vehicle fleet to the urban air pollution in the Syracuse area is most likely not significant. Also, it is possible that NMPC generating stations outside of the Onondaga Lake watershed could have produced airborne contaminants which were later deposited in the watershed.

3.5 County Sewer System

The majority of the MGP operations at the former Erie Boulevard MGP facility occurred prior to construction of the first primary sewage facility in the City of Syracuse in 1925 (Effler, 1996). Any process wastewaters generated prior to this would have likely been discharged directly to Onondaga Creek. As municipal sewers and treatment plants were constructed and expanded, the operations at the Erie Boulevard site shifted from gas manufacturing to office facilities, significantly altering its waste profile. By the late 1930s, all gas manufacturing facilities were dismantled and the site was occupied by the NMPC Headquarters and Wallace Street Garage. The current buildings at the Erie Boulevard site are connected to the municipal sewer system. It is not expected that any industrial wastewaters are currently discharged to the sewer system. Given the close proximity of the site to Onondaga Creek, stormwater runoff during the period of operation of the MGP was likely discharged to Onondaga Creek.

A similar situation occurred at the Hiawatha Boulevard site. The MGP facility began operations in 1925. By 1947, the Hiawatha Boulevard site was no longer producing gas, but did maintain gas manufacturing capabilities on a standby basis until 1958. Current operations at the site consist of a garage, an office and a meter house. Consequently, by the time that the METRO facility was operational (1960), the primary function of this site

and its waste profile had changed. During the 1970s, approximately 16 of the 20 acres at the site were used for the expansion of the METRO facility.

Although no information was provided for the Wallace Street Garage concerning hookup to the municipal sewer system, the operational years of the former garage, 1950s to 1979, would have placed it after the METRO primary treatment facility was constructed in 1955 through 1960 (Effler, 1996). Given the downtown location of the site, it is assumed that the garage was connected to the municipal sewer system. Also, given the close proximity of the site to Onondaga Creek, stormwater runoff was most likely discharged into the creek.

4.0 LIKELIHOOD OF RELEASE OF HAZARDOUS SUBSTANCES TO THE LAKE SYSTEM

4.1 Documented Releases

Historical Releases

NMPC stated in their initial response that it lacks specific information regarding hazardous waste or industrial waste which may have been released or discharged into the environment at the former Hiawatha Boulevard site (pp. 000020 - 000021). Results of the sediment sampling along the shore of Onondaga Lake near the Barge Canal indicate that MGP by-products, including PAHs, have migrated from the site into the lake. The extent of on-site contamination has not been established.

For the Erie Boulevard site, NMPC stated that it lacks specific information regarding hazardous waste or industrial waste which may have been released or discharged into the environment at the former MGP site (pp. 000020 - 000021). NMPC stated that brackish groundwater was extracted from the gravel aquifer beneath the site from approximately 1970 until July 26, 1991 for use as non-contact cooling water in the Corporate Headquarters Building cooling system on Erie Boulevard (p. 000494). The Stearns & Wheler Report (1992) (pp. 000159 - 000224), prepared for a law firm representing NMPC, stated that brackish groundwater (non-contact cooling water) was either reinjected back to the aquifer from which it was removed or discharged to Onondaga Creek. According to Stearns & Wheler, groundwater removal was on the order of 600 to 900 gallons per minute (gpm). Chloride levels in the pumping wells ranged from 645 mg/L in 1955 to 3,000 mg/L in 1992. The report alludes to the fact that measured chloride concentrations were significantly higher than 3,000 mg/L in 1991 when pumping rates

were higher (p. 000180). The dates for groundwater extraction are listed as approximately 1970 through July 1991. However, the hydrologic report states that salinity values were recorded as early as 1955 (p. 000162).

According to Stearns & Wheler, the net effect of the reinjection on the hydrologic regime was a local redistribution of salinity in the vicinity of the pumping and recharge wells. Pumping is believed to have induced an upward component to the flow of saline groundwater from the lower portions of the aquifer, which are naturally brackish, to the upper portion of the aquifer which is typically less saline. In December 1991, NMPC entered into a Consent Order (No. R7-0624-91-07) with NYSDEC and ceased discharge of brackish groundwater. NMPC obtained a SPDES permit (No. NY-0243949) in 1995 for the discharge of municipally-supplied non-contact cooling water and stormwater to Onondaga Creek. There is no indication of where NMPC obtained water for cooling or the method of disposal for cooling water between 1991 and 1995.

In May 1993, NMPC uncovered an abandoned underground storage tank (UST) from a former owner of the Erie Boulevard property behind Building E on Water Street (p. 000468). The tank contained fuel oil and was leaking. The amount of the discharge was unknown. No information was included on what remedial measures were implemented by NMPC to mitigate this leaking UST.

NMPC stated that there was no reliable information concerning spills associated with the former Wallace Street Garage due to the lack of documentation for that time period (p. 000020).

Ongoing Releases

Sediment data collected adjacent to the Hiawatha Boulevard site indicate that MGP by-products (predominantly PAHs) have migrated off-site into the lake. The source(s) of this contamination has also likely impacted soil and groundwater at the site. Because of the similarity of operations at the two former MGP sites, it is possible that NAPL discharges could be found at the Hiawatha Boulevard site similar to those observed at the Erie Boulevard site (NYSDEC, April 1997). A PSA is currently being implemented at this site under a Consent Order with NYSDEC.

Chemical data for the former Erie Boulevard MGP site indicate that by-products of the gas manufacturing process, including VOCs and SVOCs (mostly PAHs), are present in the subsurface and constitute a continuing source of soil and groundwater contamination. In the summer of 1996, NYSDEC observed a NAPL discharge into Onondaga Creek emanating from the Erie Boulevard site. NMPC installed a sheet-pile cutoff wall along the bank of the creek in late 1996 to reduce future discharges to the creek. The current effectiveness of this cutoff wall was not documented. A PSA is being implemented at this site under a Consent Order with NYSDEC.

As the former Wallace Street Garage occupied property that was originally used for the Erie Boulevard MGP, it is assumed that any residual contamination associated with the garage operations will be identified during the PSA.

4.2 Threat of Release to the Lake System

4.2.1 Extent of Site Contamination

A PSA is currently being conducted at the Hiawatha Boulevard site. The sediment data provided by NYSDEC indicate that sediments in Onondaga Lake adjacent to the site have been impacted by the operations at the former MGP site. PAH-type compounds typical of MGP operations were reported in seven sediment samples collected near the shore of Onondaga Lake. A summary of this data is provided in Section 5.3 of this report. The horizontal extent of off-site sediment contamination in Onondaga Lake has not been delineated. No on-site soil or groundwater data are currently available to determine the source(s) of off-site sediment contamination as these portions of the PSA have not been completed.

A PSA is also being conducted at the former Erie Boulevard MGP site and former Wallace Street Garage. Samples of soil, sediment and groundwater indicate that the site has been impacted by former MGP operations. A summary of this data is also provided in Section 5.3 of this report. Soil samples indicate site-wide contamination, however, horizontal and vertical delineation has not been performed. Several soil borings along the western property boundary reported elevated concentrations of contaminants indicating that contamination has likely migrated beyond the property boundary to Onondaga Creek. Analytical results from several deep soil borings (up to 86 ft bgs) also indicate that "clean" soil was not reached. Similarly, sediment samples from Onondaga Creek indicate that contaminants have entered the creek. The extent of downstream sediment contamination has not yet been established.

Groundwater samples from monitoring wells installed during the Erie Boulevard PSA indicate that the shallow aquifer has been impacted by historic site activities. Three deep groundwater monitoring wells were installed to a depth of approximately 60 ft. Chemical analyses indicate that elevated concentrations of benzene, ethylbenzene and xylenes were detected in the lower portion of the aquifer (refer to Section 5.3 for details). Historic groundwater extraction for non-contact cooling water at the Corporate Headquarters Building and subsequent reinjection to the aquifer has resulted in upwelling of brackish water to previously less saline portions of the aquifer. The off-site extent of this brackish groundwater plume has not been determined.

4.2.2 Migration Potential of Contaminants

Based on the results of sediment samples collected from the southern shore of Onondaga Lake (see Section 5.3), it appears that PAH compounds have migrated from the former Hiawatha Boulevard site into the lake. Given that the site abuts both the Barge Canal and Onondaga Lake, the potential for on-site contaminants to have reached the lake via surface water runoff, groundwater migration and/or non-aqueous phase liquid migration is very high.

Sediment samples collected in Onondaga Creek adjacent to the former Erie Boulevard MGP facility indicate that the PAH contaminants identified at on-site sampling locations have migrated off-site into the creek. High concentrations of PAHs have also been reported in soil samples to a depth of 86 ft bgs. In 1996, NMPC implemented an interim remedial measure to mitigate a NAPL seep observed emanating from the bank of Onondaga Creek adjacent to the site. It appears that contaminants are migrating from the site and entering the Onondaga Lake system. The time frame for these discharges is unknown.

It is difficult to determine the potential contribution to site contamination from the Wallace Street Garage. Sampling at the former Wallace Street Garage has focused on the impacts of the Erie Boulevard MGP facility that occupied the site prior to the Service Center Garage.

5.0 POTENTIAL FOR ADVERSE IMPACTS TO LAKE SYSTEM DUE TO A RELEASE OR THREAT OF A RELEASE

Results of the sediment samples collected in 1995 from the southern shore of Onondaga Lake adjacent to the former Hiawatha Boulevard MGP site indicate that by-products from the manufactured gas process (specifically PAHs) have migrated into the lake. BTEX compounds were also detected in some of the lake sediment samples.

The potential for contaminants to reach the lake system from the Erie Boulevard MGP site appears to be high. The western property boundary of the Erie Boulevard site is Onondaga Creek and is approximately 1.6 miles upstream of Onondaga Lake. Sediment samples collected from Onondaga Creek indicate that by-products from the manufactured gas process have migrated into the creek. A NAPL discharge was noted in Onondaga Creek adjacent to the site in 1996 (NYSDEC, April 1997). Analyses of soil boring and groundwater samples indicate that soil and the overburden aquifer beneath the site have also been impacted by historic operations. There is no site-specific analytical data to evaluate the potential contribution of former site activities at the Wallace Street Garage to the reported contamination associated with the former Erie Boulevard MGP facility.

5.1 Hazardous Substance Characteristics

The primary contaminants of concern at the Hiawatha Boulevard site and the Erie Boulevard site are NAPLs including BTEX compounds and naphthalene (LNAPLs) and other PAHs (DNAPLs). The primary substance of concern at the former Wallace Street Garage was used automotive oil.

Mobility

Volatile organics, including BTEX compounds, rapidly volatilize into the atmosphere where photooxidation produces hydrochloric acid, carbon monoxide, carbon dioxide and carboxylic acid. In surface waters, dissolved VOCs will rapidly volatilize into the atmosphere where photooxidation will occur. In soil, BTEX compounds are considered very mobile under most subsurface conditions and will readily leach into groundwater. Solubilities for benzene, toluene, ethylbenzene and xylene are relatively high, giving these compounds a high mobility in groundwater. If the concentration of lighter VOCs (such as BTEX compounds) exceeds the solubility of the various compounds in groundwater, these compounds can form a LNAPL layer which will float on top of the groundwater. Migration of the LNAPL layer will then follow the general direction of groundwater flow.

SVOCs, especially PAH-type compounds typically associated with manufactured gas operations, have relatively low mobilities. These compounds are usually categorized as DNAPLs and will migrate down through the soil and groundwater and pool at aquitards or bedrock surfaces. At the Hiawatha Boulevard site, the presence of the Solvay waste beds would provide a likely surface for DNAPL pooling. Boring logs for the Erie Boulevard site indicate sand and gravel to depths of over 80 ft bgs, with notations of sheens and free-phase product in split spoon samples. There is a potential that DNAPLs have migrated through these sand and gravel units and have reached bedrock (Vernon Shale).

Solubilities for PAHs decrease rapidly as the number of benzene rings increases. Naphthalene, with two rings, is relatively soluble (34.4 mg/L) while benzo(a)pyrene, with five rings is relatively insoluble (0.0038 mg/L). PAHs have high adsorption coefficients and will adsorb onto sediment particles, especially organic matter, so that sediment

transport is an important fate process for these compounds. There is some evidence that photooxidation can be an important fate mechanism for PAHs. However, the process may be inhibited by adsorption onto organic matter so that in waters with high suspended matter contents, e.g., eutrophic waters, the relative importance of photooxidation as a fate mechanism is dependent on the environmental conditions (USEPA, 1979).

Waste oils tend to vary in composition. Generally, they are not very soluble and would have low to moderate mobility in soil and groundwater.

Toxicity

BTEX compounds are of varying toxicity. Benzene, according to the USEPA and the Department of Health and Human Services, is a known carcinogen, based on human and animal evidence. Many epidemiological and case studies correlate benzene exposure with leukemia (ATSDR, 1992). Human acute inhalation and oral exposures to high concentrations of benzene have caused death. A low-to-moderate bioconcentration potential in aquatic organisms and some plants has been observed for benzene. However, biomagnification in aquatic food chains does not appear to be important (ATSDR, 1992). Toluene is not classified as a carcinogen in humans or animals. The main effect of toluene on humans and animals is on the nervous system, as well as slight effects on the liver, kidneys, and lungs. Toluene has a moderate tendency to bioaccumulate in the food chain (ATSDR, 1989). Ethylbenzene is not classifiable as to carcinogenicity due to lack of animal bioassays and human studies (IRIS, 1997). No carcinogenic effects have been observed for xylenes and are thus not classified as carcinogenic (IRIS, 1997). Chronic exposure to xylenes can result in effects on the liver, kidney, and central nervous system.

Polycyclic aromatic hydrocarbons are a class of compounds containing two or more aromatic (benzene) rings. PAHs are formed during the incomplete burning of fossil fuel, garbage, or other organic matter and have been investigated in soil at former manufactured-gas sites and abandoned creosote wood treatment plants. Exposure to PAHs may occur by contact with PAH-containing products such as creosote-treated wood, asphalt roads, or coal tar (ATSDR, 1988). The toxicity of select PAHs found at the former MGP sites is discussed below.

Naphthalene is a PAH containing two aromatic rings. Limited data exist for naphthalene, which is not classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays (IRIS, 1997).

Phenanthrene, anthracene, and fluoranthene each contain three aromatic rings. Limited data exist for each substance, which are each not classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays (IRIS, 1997). For fluoranthene, data from skin painting bioassays were judged inadequate because no increases in incidences of tumors were observed and the tested group sizes were too small.

Pyrene, chrysene, benzo(a)anthracene, benzo(b)fluoranthene, and benzo(k)fluoranthene each have four aromatic rings. Limited data exist for pyrene, which is not classified as a human carcinogen (IRIS, 1997). Chrysene is a carcinogen in animals following long-term dermal application. However, there are no studies correlating human chrysene exposure and tumor development, although there are numerous studies indicating human cancer from exposure to mixture of PAHs that include chrysene (ATSDR, 1988). Chrysene is classified as a probable human carcinogen based on animal bioassays (IRIS, 1997). PAHs, including chrysene, accumulate in the sediment of waterbodies and in aquatic organisms. Similar to chrysene, benzo(a)anthracene is an experimental

carcinogen by the dermal route of exposure. There is also some evidence that benzo(a)anthracene is carcinogenic by the oral route as well (ATSDR, 1988). Benzo(b)fluoranthene is also an experimental carcinogen by the dermal route of exposure; other routes of exposure including inhalation and oral routes were not studied for benzo(b)fluoranthene (ATSDR, 1988). According to USEPA, benzo(k)fluoranthene is classified as a probable human carcinogen, based on no human data but sufficient data from animal bioassays (IRIS, 1997). The substance produced tumors after lung implantation in laboratory animals and in skin painting studies.

Benzo(a)pyrene and dibenz(a,h)anthracene each have five aromatic rings. Long-term exposure to benzo(a)pyrene in animal studies has resulted in the induction of cancer, by all routes for which humans would normally expect to be exposed (ATSDR, 1988). Benzo(a)pyrene is classified as a probable human carcinogen (IRIS, 1997) and is one of the most toxic PAHs, whose effects include non-cancer lung diseases, such as bronchitis, and numerous types of skin lesions. Many aquatic organisms metabolize and excrete benzo(a)pyrene rapidly, resulting in short-term bioaccumulation. Dibenz(a,h)anthracene is also a carcinogen by the dermal route of exposure in laboratory animals. Evidence also suggests that dibenz(a,h)anthracene is an experimental carcinogen by the oral route (ATSDR, 1988). There are also studies associating human cancer to exposure to a mixture of PAHs, including dibenz(a,h)anthracene. Similar to other PAHs, these two substances accumulate in the sediment of waterbodies and in aquatic organisms.

According to Long and Morgan (1990) as presented in NYSDEC (1993), the low and median toxic effects (Effects Range-Low [ER-L] and Effects Range-Median [ER-M]) and Overall Apparent Effects Threshold concentrations for benthic organisms exposed to benzo(a)pyrene are 400 micrograms per kilogram (μg/kg), 2,500 μg/kg, and 700 μg/kg, respectively. The ER-L and ER-M threshold concentrations for total PAHs are

4,000 μg/kg and 35,000 μg/kg, respectively. According to NYSDEC (1993), the sediment criterion for benzo(a)pyrene, based on protection for human health bioaccumulation, is 1.3 μg/g-oc (organic carbon normalized) in freshwater systems. Although no sediment total organic carbon (TOC) data were provided, assuming 1% to 10% TOC, the site-specific sediment criterion for benzo(a)pyrene would range from 13 to 130 μg/kg, values less than the ER-L. As summarized in Section 5.3, this PAH was detected at levels above the ER-M concentration in sediments in Onondaga Lake adjacent to the Hiawatha Boulevard site and in sediments in Onondaga Creek adjacent to the Erie Boulevard site.

Because waste oil can contain various mineral oils, hydrocarbons and chlorinated hydrocarbons that are known carcinogens, the Material Safety Data Sheet classifies waste oil as a carcinogen.

Persistence

In surface waters and surficial soils, VOCs will predominantly volatilize into the atmosphere where they rapidly degrade. In subsurface soils where volatilization does not readily occur, VOCs are much more persistent. VOCs will also leach from soils into groundwater. Once in groundwater, VOCs will not readily volatilize and are relatively persistent.

SVOCs, and particularly the longer-ringed PAHs, are relatively persistent in the environment. The dissolved fraction of SVOCs can undergo rapid photolysis in surface waters. However, the strong adsorption characteristics tend to inhibit photolysis. In groundwater, SVOCs are persistent.

The higher molecular weight components of waste oils are relatively persistent, have low water solubilities and will not easily volatilize when exposed to air. Consequently, the heavier compounds will remain on the soil. In the water column, these heavier compounds will adsorb to suspended matter and settle to the sediment and will likely biodegrade (ATSDR, 1993).

Bioaccumulation

The potential for bioaccumulation of benzene, xylenes and other VOCs has been found to be low. Toluene has not been found to bioaccumulate (USEPA, December 1979).

Aquatic organisms are able to bioaccumulate some hydrocarbons over a short period of time, but depuration will occur after the source/spill has ceased (ATSDR, 1993).

PAHs have shown rapid uptake rates in aquatic organisms from zooplankton to fish. PAHs with two to four rings are readily metabolized and excreted by organisms. The five-ringed PAHs are also readily bioaccumulated in organisms but the rate of metabolism is much slower (USEPA, 1979).

5.2 Quantity of Substance

On-site analytical data were not available for review for the Hiawatha Boulevard site. A PSA is currently in progress. Therefore, the quantity of contaminants at the site cannot be estimated. Similarly, the amount of contaminants potentially entering Onondaga Lake also cannot be quantified at this time.

The Erie Boulevard site is currently under investigation. Although contamination has been identified, sampling results delineating the full horizontal and vertical extent of this contamination was not established during the PSA. Consequently, the quantity of contaminants released on-site cannot be estimated. The Wallace Street Garage was located on property which was formerly part of the Erie Boulevard MGP. Sampling conducted as part of the Erie Boulevard PSA appears to have included the areas adjacent to the former boundaries of the Wallace Street Garage.

5.3 Levels of Contaminants

Hiawatha Boulevard Site

The results from seven sediment samples collected in July 1995 as part of the Hiawatha Boulevard PSA from the shoreline of Onondaga Lake were provided by NYSDEC (September 30, 1996). These samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and six miscellaneous parameters to determine hazardous waste characteristics including corrosivity, cyanide, reactive cyanide, reactive sulfide and ignitability. Sample locations are shown on Figure 2. Location SED-01 was not shown on the map provided by NYSDEC, however, assuming equal spacing, the location would be approximately 200 ft south of location SED-02. The site-specific cleanup criteria for sediment at or near the Hiawatha Boulevard site has not been established. Results of the VOC analyses reported most targeted compounds below detection limits. VOCs were reported at elevated concentrations in two samples. Toluene was reported at a concentration of 43 μg/kg in SED-05. Analyses of sediment sample SED-07 reported concentrations of toluene at 26 μg/kg (estimated), ethylbenzene at 370 μg/kg and total xylenes at 410 μg/kg.

Several SVOCs, mainly PAHs, were reported in all seven sediment samples. For the prevalent PAHs, the maximum concentrations detected at the seven locations and the concentrations at the two locations closest to the site, SED-02 and SED-03, are provided in Table 1. The ecological effects threshold concentrations (ER-L and ER-M) are also included in this table. Concentrations of many of the PAHs detected at the two locations near the site were significantly greater than the ER-M threshold values.

TCL pesticides were detected in trace amounts, less than 10 μg/kg at three locations, SED-01, SED-04 and SED-06. PCB Aroclor 1254 was reported at SED-04 at an estimated concentration of 12 μg/kg. PCBs were not detected at other sediment sample locations.

Metals results were compared to the sediment criteria in NYSDEC's Technical Guidance for Screening Contaminated Sediments (1993). Lead exceeded the Severe Effects Threshold criterion at location SED-01. All other metals were reported below their respective Severe Effects Threshold criterion.

Based on TCLP testing, sediment at location SED-03 near the site was not considered hazardous.

Erie Boulevard Site

Two test pits were excavated in August and September 1995 near the western property boundary of the Erie Boulevard site adjacent to Onondaga Creek. Two soil samples were collected in test pit TP-1 and five soil samples (plus one duplicate) were collected in test pit TP-2. High concentrations of VOCs were reported in one of the test pits (TP-1). Benzene was reported at a concentration of 5,500 μg/kg (60 μg/kg recommended soil

cleanup objective as per NYSDEC TAGM #HWR-94-4046, 1994), toluene at 18,000 μg/kg (1,500 μg/kg soil cleanup objective), ethylbenzene at 66,000 μg/kg (5,500 μg/kg soil cleanup objective) and total xylene at 140,000 μg/kg (1,200 μg/kg soil cleanup objective).

High concentrations of several PAHs were reported in both test pits TP-1 and TP-2. These PAHs include: benzo(a)anthracene at concentrations ranging from 3,000 μg/kg to 32,000 μg/kg (224 μg/kg soil cleanup objective), chrysene at concentrations ranging from 3,300 μg/kg to 32,000 μg/kg (400 μg/kg soil cleanup objective), benzo(b)fluoranthene at concentrations ranging from 5,600 μg/kg to 67,000 μg/kg (1,100 μg/kg soil cleanup objective), benzo(k)fluoranthene at concentrations ranging from 6,500 μg/kg to 30,000 μg/kg (1,100 μg/kg soil cleanup objective), benzo(a)pyrene at concentrations ranging from 6,500 μg/kg to 38,000 μg/kg (61 μg/kg soil cleanup objective), indeno(1,2,3-cd)pyrene at concentrations ranging from an estimated 1,100 μg/kg to 18,000 μg/kg (3,200 μg/kg soil cleanup objective) and dibenz(a,h)anthracene at estimated concentrations ranging from 190 μg/kg to 4,400 μg/kg (14 μg/kg soil cleanup objective). In addition, TP-1 reported concentrations of naphthalene at 400,000 μg/kg (13,000 μg/kg soil cleanup objective) and 2-methylnaphthalene at 260,000 μg/kg (36,400 μg/kg soil cleanup objective).

The results of metals analyses from soil samples collected in the test pits reported concentrations of calcium, magnesium, mercury and zinc above their respective Eastern USA background concentrations (NYSDEC, 1993).

Results of the TCLP analyses on soil from TP-1 reported leachable quantities of benzene at 86 micrograms per liter (μg/L) (500 μg/L regulatory limit for hazardous waste characterization as per 40 CFR 261.24), barium at 742 μg/L (100 mg/L limit), cadmium

at 5.9 μg/L (1,000 μg/L limit) and reactive sulfide at 246 mg/kg (500 mg/kg limit). Thus, based on this limited data, the soil at this location would not be characterized as hazardous waste.

Numerous soil borings were drilled throughout the Erie Boulevard site in July and August 1995. The higher concentrations of contaminants appear to be located in the western portion of the site as evidenced in the sample results discussed below. Results from subsurface soil samples collected from borings reported high concentrations of VOCs such as benzene, ranging from not-detected to 99,000 μg/kg (60 μg/kg soil cleanup objective). Toluene was reported above the recommended soil cleanup objective of 1,500 μg/kg at concentrations ranging from not-detected to 120,000 μg/kg. Ethylbenzene was reported above the recommended soil cleanup objective of 5,500 μg/kg at concentrations ranging from not-detected to 34,000 μg/kg. Xylene (total) was reported above the recommended soil cleanup objective of 1,200 μg/kg at concentrations ranging from not-detected to 220,000 μg/kg.

Elevated concentrations of several SVOCs were also reported in soil boring samples. Benzo(a)pyrene was reported above the recommended soil cleanup objective of 61 μg/kg at concentrations ranging from not-detected to 1,900,000 μg/kg. Chrysene was reported above the recommended soil cleanup objective of 400 μg/kg at concentrations ranging from not-detected to an estimated 1,400,000 μg/kg. Additional PAH compounds such as benzo(a)fluoranthene, benzo(b)fluoranthene, anthracene, phenanthrene and pyrene were also reported in several soil borings at concentrations significantly greater than their respective recommended soil cleanup objectives. Results of TAL metals analyses were compared to the Eastern USA background concentrations. Calcium, magnesium and mercury were reported above their respective background concentrations in these subsurface soil samples.

Monitoring wells were installed at the site in July and August 1995 and were sampled in August 1995. High concentrations of VOCs, mostly BTEX compounds, were detected in two shallow monitoring wells on the western side of the Erie Boulevard site, adjacent to Onondaga Creek. Benzene was reported at concentrations of 7,500 μg/L (duplicate 8,100 μg/L) and 1,800 μg/L (Class GA groundwater standard of 0.7 μg/L). Toluene was reported at concentrations of 1,600 μg/L (duplicate 1,700 μg/L) and 120 μg/L (groundwater standard of 5 μg/L). Ethylbenzene was reported at concentrations of 2,700 μg/L (duplicate 2,800 μg/L) and 1,700 μg/L (groundwater standard of 5 μg/L). Xylene (total) was reported at concentrations of 4,000 μg/L (duplicate 4,200 μg/L) and 1,400 μg/L (groundwater standard of 5 μg/L). Of the three deep monitoring wells, only one well contained detected concentrations of benzene (19 μg/L estimated), ethylbenzene (48 μg/L estimated) and total xylenes (70 μg/L).

Several SVOCs were also reported above their respective Class GA groundwater standards at on-site monitoring wells. Phenol was reported in shallow monitoring wells samples at concentrations ranging from not-detected to an estimated 240 μg/L (groundwater standard of 1 μg/L). Acenaphthene was reported in both shallow and deep monitoring well samples at concentrations ranging from not-detected to an estimated 580 μg/L (groundwater standard of 20 μg/L). Naphthalene was reported in both shallow and deep monitoring well samples at concentrations ranging from not-detected to 14,000 μg/L (groundwater standard of 10 μg/L). Chrysene was reported at concentrations ranging from not-detected to an estimated 69 μg/L (no NY State Class GA standard). Fifteen other SVOCs were detected in shallow monitoring well samples including acenaphthylene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, dibenzofuran, diethylphthalate, 2,4-dimethylphenol, fluoranthene, fluorene, 2-methylnaphthalene, 4-methylphenol, phenanthrene and pyrene.

Five sediment samples were collected in Onondaga Creek as part of the Erie Boulevard PSA on August 24, 1995. SED-5 was collected approximately 600 ft upstream of the site and SED-4 was collected approximately 200 ft upstream of the site. SED-3 and SED-2 were collected adjacent to the site and SED-1 was collected immediately downstream of the site. Results of these samples collected adjacent to the site reported all targeted VOCs at trace amounts or below method detection limits with the exception of acetone which appears to be a laboratory contaminant. Benzene and toluene were reported as not-detected. Ethylbenzene was reported at an estimated concentration of 2 μg/kg in sample SED-2. Total xylenes were reported at a concentration of 40 μg/kg in sample SED-2 and at an estimated concentration of 7 μg/kg in sample SED-4. Results of the SVOC analyses reported several PAHs at very high concentrations including: phenanthrene which was reported at concentrations ranging from 7,200 μg/kg in SED-5 to 120,000 μg/kg in SED-2 (1,380 μg/kg ER-M threshold); fluoranthene at concentrations ranging from 7,900 μg/kg in SED-5 to 100,000 μg/kg in SED-2 (3,600 μg/kg ER-M); and, benzo(a)pyrene at concentrations ranging from 3,100 μg/kg in SED-5 to 50,000 μg/kg in SED-4 (2,500 μg/kg ER-M). Results of the pesticide/PCB analyses reported all targeted compounds below method detection limits with the exception of a few trace detections of pesticides. Results of TAL metals analyses were compared to the sediment criteria in NYSDEC's Technical Guidance for Screening Contaminated Sediments (1993). Copper and zinc exceeded the Severe Effects Threshold criterion at location SED-1 and lead exceeded its Severe Effects Threshold criterion at location SED-4. All other TAL metals were reported at concentrations below their respective Severe Effects Threshold criterion.

Surface water quality data was not collected by NMPC during the PSA. NYSDEC collected sediment and surface water samples in Onondaga Creek in November 1996. A surface water sample (location O-4) was collected in Onondaga Creek adjacent to the site upstream of West Genesee Street. VOCs, including BTEX compounds, and SVOCs,

including PAHs, were either not-detected (less than 10 μg/L) or were detected at estimated concentrations near the detection limit. PCBs were not-detected (less than 0.5 μg/L per Aroclor). A sediment sample was not collected at location O-4. A sediment sample (location O-3) was collected in Onondaga Creek approximately 2,000 ft downstream of location O-4. PAHs were detected in sediment at this location, including phenanthrene (11,000 μg/kg), anthracene (4,000 μg/kg), fluoranthene (15,000 μg/kg), pyrene (21,000 μg/kg) and benzo(a) pyrene (9,900 μg/kg), among others. These PAHs were detected at lower concentrations at Station O-6, approximately one mile upstream, including phenanthrene (3,400 μg/kg), anthracene (estimated 690 μg/kg), fluoranthene (4,100 μg/kg), pyrene (5,300 μg/kg) and benzo(a)pyrene (2,200 μg/kg).

Maps provided by NMPC indicate that the Wallace Street Garage occupied Building D which is now part of the current Erie Boulevard Corporate Headquarters (pp. 000124 - 000132). Prior to the garage, this portion of the site was occupied by structures (gas holders) associated with the former Erie Boulevard MGP operations. No specific analytical data were provided for the Wallace Street Garage site. However, several borings and monitoring wells installed to evaluate the MGP facility as part of the PSA are adjacent to Building D (p. 001150). Test pit TP-1 is also adjacent to Building D. Sediment sample SED-2 is located west of Building D in Onondaga Creek. A summary of the sampling results from these locations was discussed above in relation to the PSA at the former Erie Boulevard MGP facility. Many of these samples reported high concentrations of BTEX compounds and PAHs characteristic of former MGP operations. It is difficult to distinguish what portion, if any, of the contamination present in these samples can be attributed to former garage operations.

5.4 Impacts on Special Status Areas

The portions of Onondaga Lake and the Barge Canal near the Hiawatha Boulevard site are Class C waterbodies (6 NYCRR Part 895). The NY State freshwater wetland designated SYW12 begins immediately north of the Barge Canal and continues around the eastern shore of Onondaga Lake to the confluence of Ley Creek. Another state wetland area, designated SYW19, is located approximately 1,500 ft to the south of the site along the shoreline of the lake near Harbor Brook. The potential impact on these state wetland areas is difficult to assess as circulation patterns in Onondaga Lake would provide the only mechanism capable of transporting contaminants from the site to the wetlands areas. According to the Syracuse West National Wetlands Inventory (NWI) Map (USDOI, 1978), these state wetlands are also federal wetlands and are classified as Palustrine, Emergent Marsh (PEM). Also, the near-shore open water portion of Onondaga Lake, across the Conrail tracks, is classified as a Lacustrine, Littoral, Open Water Wetland (L2OWH). As discussed in Section 5.3, sediments in the littoral zone near the Hiawatha Boulevard site contain elevated concentrations of PAHs. It is believed that former MGP operations at the site have contributed to this contamination.

Onondaga Creek, adjacent to the Erie Boulevard and the former Wallace Street Garage sites, is a Class C waterbody (6 NYCRR Part 895). There are no state wetlands in the vicinity of these two sites. The Syracuse West NWI map indicates that Onondaga Creek is a federal wetland classified as a Riverine, Lower Perennial, Open Water Wetland (R2OWH). As discussed in Section 5.3, sediments in Onondaga Creek near the Erie Boulevard site contain elevated concentrations of PAHs. It is believed that former MGP operations at the site have contributed to this contamination.

As of August 1996, there were no New York State "Natural Heritage Sensitive Elements" known in the immediate vicinity of these three sites (within one mile).

6.0 SUMMARY OF CONCERNS

Except for sediment data from Onondaga Lake, analytical data from the Hiawatha Boulevard Preliminary Site Assessment were not available for review as the majority of the proposed field work has not commenced. However, the sediment data indicate that MGP by-products (mostly PAHs) have migrated from the site and have contributed to the contamination of the lake. Given the levels of contamination encountered at the Erie Boulevard site, a similar level of contamination could be expected at the Hiawatha Boulevard site. The potential for NAPLs to be present at the site is also high. Given the shallow water table and the shallow depth to the Solvay waste beds, the potential for contaminants to migrate off-site and reach Onondaga Lake is high.

The results of the PSA at the Erie Boulevard site indicate high levels of contamination in soil and groundwater. Sediment data indicate that contaminants have migrated into Onondaga Creek. The proximity of the site to Onondaga Creek and the operational period of the MGP facility, 1840s to 1930s, provide for a very high probability that historic contamination from the site reached the Onondaga Lake system. More recently, a NAPL discharge into Onondaga Creek was reported by NYSDEC in 1996. A sheet pile cut-off wall was installed to prevent further discharges from reaching the creek. The effectiveness of this remedial measure was not documented. DNAPLs appear to have affected the deeper portions of the sand and gravel aquifer as sheens and free-phase product were noted in several soil boring to depths of 80 ft bgs without encountering "clean soil".

More recent releases from the Headquarters Office Complex at the Erie Boulevard site included the discharge of brackish groundwater, used as non-contact cooling water, into Onondaga Creek or reinjected back to the aquifer. Naturally brackish groundwater from the deeper portion of the gravel aquifer beneath the site was extracted from the early 1970s

to 1991 for use as non-contact cooling water. Well records indicate pumping well depths of 61 ft to 70 ft bgs. Although accurate pumping records were not maintained, the potential volumes of water were significant with extraction rates of 600 gpm to 900 gpm. These extraction rates equal several hundred thousand gallons of discharge per day during normal business hours. Actual salinity values were not provided to evaluate the water quality being discharged to Onondaga Creek or reinjected back into the aquifer. Groundwater chemical analyses for VOCs and SVOCs were not collected by Stearns & Wheler from the extraction wells, nor was any information provided indicating that these extraction wells were sampled during the PSA. It is difficult to determine the potential contaminant levels present in the extraction wells as the monitoring wells installed in the deeper portion of the aquifer as part of the PSA were not drilled in close proximity to these wells. Extraction Well B is approximately 140 ft downgradient of PSA monitoring well MW-8D (located in the southwest corner of the site), which reported elevated concentrations of total BTEX (137 μg/L) and total PAHs (131.5 μg/L). This water was then reinjected back to the aquifer in the south-central portion of the site or discharged directly to Onondaga Creek. Consequently, there is a strong possibility that contaminated groundwater was reinjected back to the aquifer or discharged to Onondaga Creek. There are no monitoring wells in the vicinity of the reinjection well. Given the pumping rates, the mass loading to either the aquifer or Onondaga Creek could be significant.

The potential contribution from the former Wallace Street Garage to the contamination reported in the Erie Boulevard MGP PSA is difficult to assess. Although Building D was identified as the former garage structure, this portion of the site was formerly occupied by gas holders. Since the garage was built over former MGP structures, this area was evaluated at least indirectly during the PSA of the MGP facility. Analytical data collected in the vicinity of Building D reported high concentrations of BTEX and PAHs. It is

difficult to determine what portion, if any, of the contamination present in these samples could be attributed to former garage operations.

Both the Hiawatha Boulevard and Erie Boulevard MGP facilities used coal to manufacture gas and heat the reaction vessels. NMPC did not include estimates as to the amount of coal potentially used by the operations. However, the volumes appear to be significant in that a 42,000-ton coal stockpile was maintained at the Hiawatha Boulevard site to sustain production in case of coal strikes. Given the age of these facilities, it is unlikely that any air emissions controls were in effect. Significant quantities of organic and inorganic compounds from ash and soot could have been introduced into the atmosphere by burning coal and subsequently deposited into the Onondaga Lake system.

REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). U.S. Public Health Service. Toxicological Profiles. (Various Substances). Various dates, 1988 - 1993.

Effler, S.W. 1996. Limnological and Engineering Analysis of a Polluted Urban Lake: Prelude to Environmental Management of Onondaga Lake, New York.

IRIS (Integrated Risk Information System). On-Line Database. U.S. Environmental Protection Agency. Database Searches, 1996 and 1997.

Montgomery, J.H., and L.M. Welkom. 1990. Groundwater Chemicals Desk Reference. Lewis Publishers, Inc.

New York State Department of Environmental Conservation. November 1993. Technical Guidance for Screening Contaminated Sediments. Division of Fish and Wildlife. Division of Marine Resources.

New York State Department of Environmental Conservation, January 24, 1994. Technical and Administrative Guidance Memorandum (TAGM) on Determination of Soil Cleanup Objectives and Cleanup Levels, #HWR-94-4046.

New York State Department of Environmental Conservation, September 30, 1996. Correspondence No. 1 with TAMS which included draft copies of the PSA analytical data for the Hiawatha Boulevard Site (sediment data collected on July 27, 1995) and the Erie Boulevard Site (soil, sediment and groundwater data from 1995), Geraghty & Miller, Inc.

New York State Department of Environmental Conservation, March 18, 1997. Correspondence No.2 with TAMS which included copies of figures from the Erie Boulevard PSA, Geraghty & Miller, Inc., March 1996.

New York State Department of Environmental Conservation, April 10, 1997. Internal Memorandum from Gardiner Cross (BSC) to Alyse Peterson (BCRA). Comments on the Site Summary Report for Niagara Mohawk Power Corporation sites near Onondaga Lake.

New York State Department of Environmental Conservation, December 11, 1997. Comments on the Draft Revision 1 Site Summary Report for Niagara Mohawk Power Corporation, Site IDs 227, 228 and 232.

New York State Department of Environmental Conservation, December 15, 1997. Internal Memorandum from S. Eidt to K. Lesley Kenty. Comments on the Site Summary Report for Niagara Mohawk Power Corporation, Site IDs 227, 228 and 232.

Niagara Mohawk Power Corporation, April 4, 1995. Response to Request for Information.

Niagara Mohawk Power Corporation, April 28, 1995. Response to Request for Information.

Niagara Mohawk Power Corporation, February 9, 1996. Supplemental Response to Request for Information.

Rickard, L.V. and D.W. Fischer. 1970. Geologic Map of New York, Finger Lakes Sheet (1:250,000). New York State Museum and Science Service Map and Chart Series Number 15.

Standen, A. 1969. Encyclopedia of Chemical Technology, Second Edition, Vol. 19. Interscience Publishers.

Stearns & Wheler. April 1992. Study of the Influence of Groundwater Recharge at 300 Erie Boulevard West, Syracuse, NY.

United States Department of the Interior, Fish and Wildlife Service, 1978. National Wetlands Inventory Map: Syracuse West, New York (1:24,000).

United States Environmental Protection Agency (USEPA). December 1979. Water-Related Environmental Fate of 129 Priority Pollutants, Volumes I & II. Washington, D.C.

Upstate Freshwater Institute (UFI). 1994. The State of Onondaga Lake.

TABLE 1

CONCENTRATIONS OF SELECT PAHs IN SEDIMENT SAMPLES FROM ONONDAGA LAKE NIAGARA MOHAWK'S HIAWATHA BOULEVARD SITE (SITE ID 227)

COMPOUND	ECOLOGICAL EFFECTS CONCENTRATIONS (µg/kg) [1]		CONCENTRATION ADJACENT TO SITE (µg/kg) [2]		HIGHEST CONCENTRATION [2] (µg/kg)
	ER-L	ER-M	SED-02	SED-03	
Naphthalene	340	2,100	860 J	350 J	4,400 J (SED-07)
2-Methylnaphthalene	65	670	760 J	220 J	2,800 J (SED-07)
Acenaphthylene	--	--	1,400 J	370 J	2,600 J (SED-07)
Acenaphthene	150	650	2,500 J	1,400	14,000 (SED-07)
Fluorene	35	640	2,300 J	370 J	3,100 J (SED-07)
Phenanthrene	225	1,380	18,000	3,700	21,000 (SED-07)
Anthracene	85	960	6,200	1,100	10,000 (SED-07)
Fluoranthene	600	3,600	13,000	2,400	13,000 (SED-02, -07)
Pyrene	350	2,200	16,000	2,900	18,000 (SED-07)
Benzo(a)anthracene	230	1,600	7,400	1,400	7,600 (SED-07)
Chrysene	400	2,800	7,400	1,400	8,700 (SED-07)
Benzo(b)fluoranthene	--	--	5,400	1,200	5,400 (SED-02)
Benzo(k)fluoranthene	--	--	3,400 J	580 J	3,700 J (SED-07)
Benzo(a)pyrene	400	2,500	6,500	1,300	6,500 (SED-02)
Indeno(1,2,3-cd)pyrene	--	--	2,300 J	450 J	2,300 J (SED-02)
Dibenz(a,h)anthracene	60	260	1,000 J	220 J	1,000 J (SED-02, -07)

Notes:

1. Ecological Effects Concentrations from Long and Morgan (1990) presented in NYSDEC (1993)
   ER-L = Effects Range - Low
   ER-M = Effects Range - Median
2. Niagara Mohawk data provided by NYSDEC (1996) from Geraghty & Miller (1996)
3. All concentrations in µg/kg (ppb)
4. J = Estimated value
5. Sediment samples collected in July 1995 in Onondaga Lake near shore, see Figure 2

Site Location: Niagara Mohawk Power Corporation Facilities (Sites 227, 228,232)

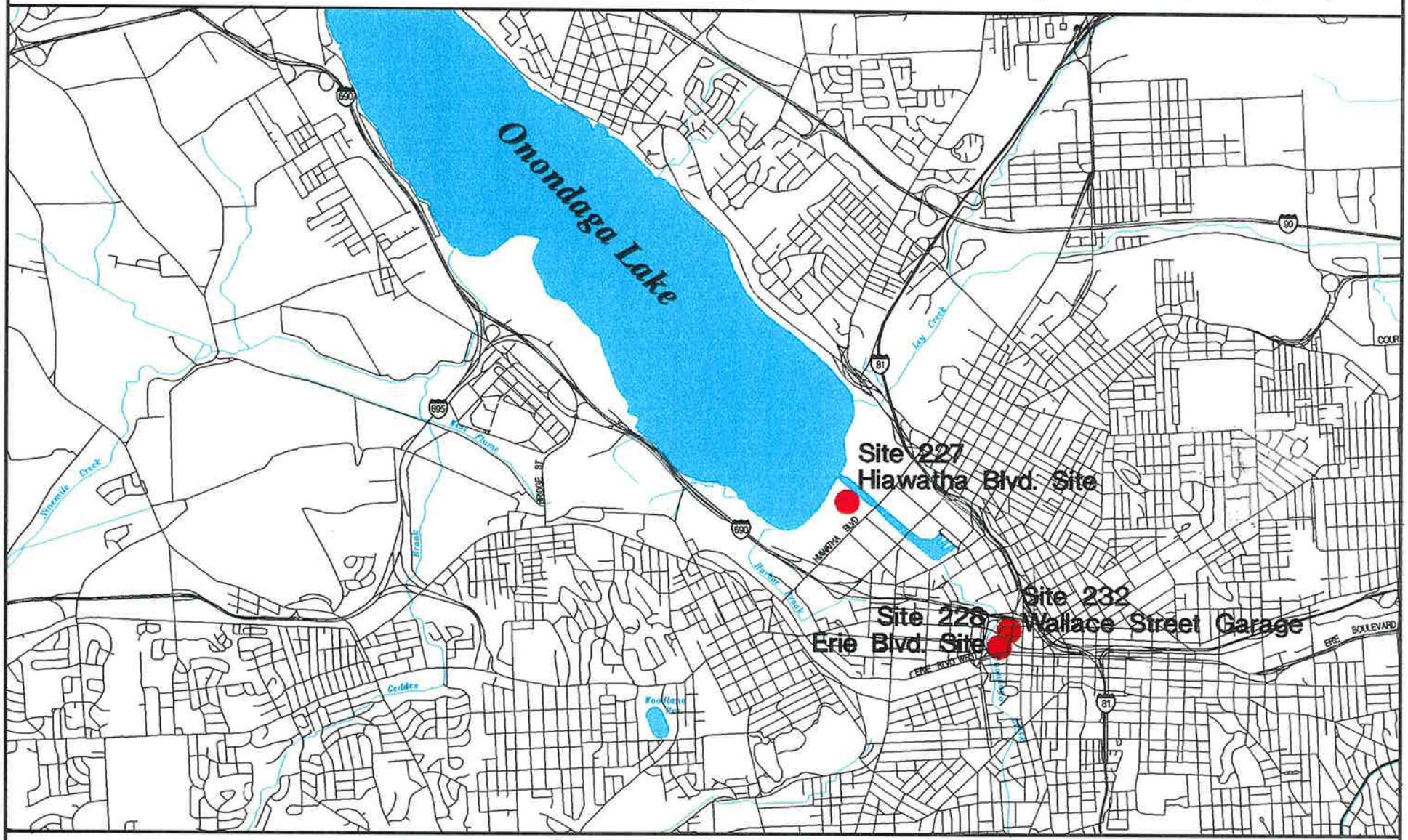

Figure 1

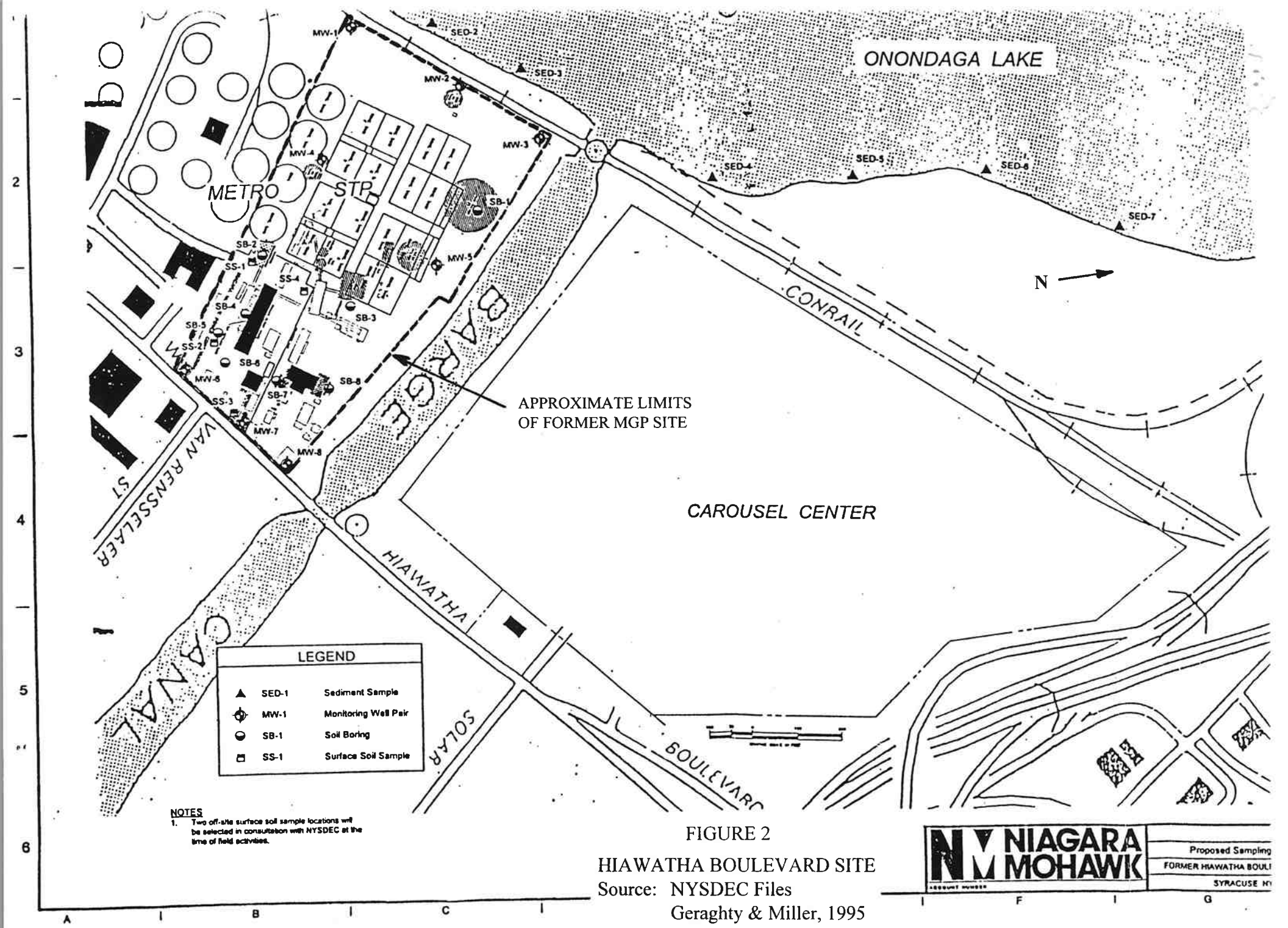

FIGURE 2

HIAWATHA BOULEVARD SITE

Source: NYSDEC Files
Geraghty & Miller, 1995

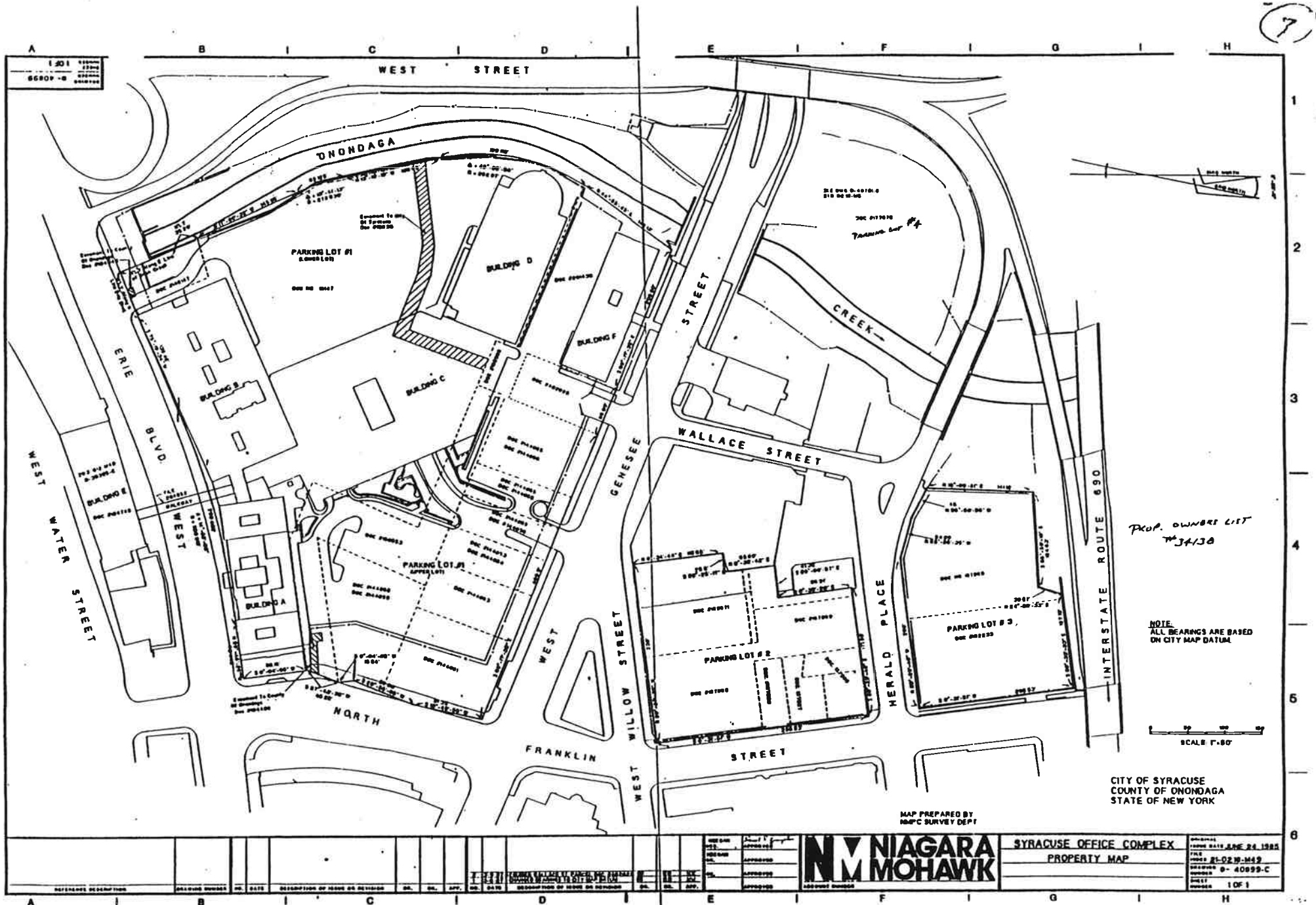

FIGURE 3

ERIE BOULEVARD & WALLACE STREET GARAGE SITES
Source: NMPC Initial Response dated April 28, 1995

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